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<p>(21) International Application Number: PCT/AU87/00379 (22) International Filing Date: 11 November 1987 (11.11.87) (31) Priority Application Number: PH 8925 (32) Priority Date: 12 November 1986 (12.11.86) (33) Priority Country: AU (71) Applicant (for all designated States except US): ELTEK HOLDINGS PTY. LTD. [AU/AU]; 90-94 Tram Road, Doncaster, VIC 3108 (AU). (72) Inventor; and (75) Inventor/Applicant (for US only) : KNIGHT, John, Keith [NZ/AU]; 16 Frederick Street, Doncaster, VIC 3108 (AU). (74) Agents: PRYOR, Geoffrey, Charles et al.; Davies &amp; Collison, 1 Little Collins Street, Melbourne, VIC 3000 (AU).</p>		<p>(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent), US.  Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>
<p>(54) Title: POLE REINFORCEMENT SYSTEM</p> <p>(57) Abstract</p> <p>A method and apparatus for reinforcing the buried end of a wooden utility pole (4). The method uses elongate curved elements (2) which are spaced about the periphery of the pole and driven into the ground so that their lower ends are buried. Bolts (52) which pass through the pole are used to firmly clamp the members (2) to the pole (4).</p> <div data-bbox="974 1113 1169 1911"> </div>		

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1.

POLE REINFORCEMENT SYSTEM

This invention relates to a pole reinforcement system.

More particularly, this invention relates to a pole reinforcement system which can be used to reinforce the buried ends of wooden poles.

The general object of the invention is to provide a simple yet effective technique which can be used to reinforce the buried ends of wooden poles such as utility poles. The structural properties of utility poles can be very seriously downgraded by rotting which usually occurs a short distance beneath the ground level. The technique of the invention provides a simple yet effective technique of reinforcing the poles so as to prolong their useful life.

According to the present invention there is provided a method of reinforcing a pole, the method comprising the steps of placing a first elongate reinforcing member adjacent to the pole, said elongate member being curved in transverse cross-section so as to partly surround the periphery of the pole, driving the member downwardly so that its lower portion is embedded in the ground adjacent to the buried end of the pole, placing a second elongate member adjacent to the pole, said second

elongate member being curved in transverse cross-section so as to partly surround the periphery of the pole and being located so that one edge region thereof overlaps one edge region of the first member, driving the second elongate member so that its lower portion is embedded in the ground adjacent to the buried end of the pole and fixing the first and second members to the pole.

The invention will now be further described with reference to the accompanying drawings, in which:

Figure 1 is a side view of a reinforcing member of the invention,

Figure 2 is an edge view of the member,

Figure 3 is a plan view of the member,

Figure 3, 4 and 4A show diagrammatically the positioning of the elongate member with respect to a pole to be reinforced,

Figure 5 shows the final position of the member,

Figure 6 is a diagrammatic cross-sectional view showing four reinforcing members surrounding the pole,

Figure 7 shows a modified arrangement using three reinforcing members,

Figure 8 illustrates a technique for boring through the pole,

Figure 9 shows a cross-section through the reinforced pole, and

Figure 10 shows the pole as reinforced in accordance with the invention.

Figures 1 to 3 show a preferred form of reinforcing member 2 constructed in accordance with the invention. The reinforcing member is typically three metres long and is fabricated from H.U. 280 steel and is preferably three millimetres in

thickness. As seen in Figure 2, the member 2 is curved in cross-section and the radius R is in the range from 120 to 250 mm. The member 2 subtends an angle A which is in the range 90 to 180° so that it will embrace about 20 to 40% of the periphery of a pole 4 to be reinforced. The member 2 includes a driving lug 6 welded on the convex face 8 of the member substantially midway along the length of the member. The member has upper mounting holds 3 and 5 and central mounting holes 7 and 9.

Figures 4 and 5 diagrammatically illustrate driving the member 2 into the ground 10 adjacent to the buried end 12 of the pole 4. The buried end 12 may include rotted regions 14, as shown. The member 2 is placed adjacent to the pole 4 with its concave side 16 partly surrounding the pole. The lower end 18 of the member rests on the ground 10. A number of restraining bands 20 are used to hold the concave face 16 of the member adjacent to the pole whilst a driving force is applied to the lug 6. This ensures that the lower end 18 of the member penetrates the ground and remains adjacent to the surface of the buried end 12 of the pole. The restraining bands 20 may comprise rollers 22 mounted for rotation on curved shafts 24, the ends of the shafts 24 being connected to chains 26. Chain tensioning devices 28 are included so as to apply tension to the chains and thus cause the rollers 22 to very firmly hold the concave face 16 of the member 2 adjacent to the surface of the pole. As mentioned before, this ensures that the member 2 remains adjacent to the buried surface of the pole, as shown in Figure 4. As seen in Figure 4A, the restraining band 20 can be successively removed to permit the lug to pass to its final position just

beneath the level of the ground, as shown in Figure 5.

A number of similar reinforcing members 2 can be driven into the ground adjacent to the pole, in a similar manner.

Figure 6 shows an arrangement in which a first member 2 is located at one side of the pole and a second member 30 is located diametrically opposite the first member 2. Third and fourth members 32 and 34 are provided in diametrically opposite positions and their longitudinal side portions 36 overlap adjacent side portions 38 of the first and second members 2 and 30. In this way the entire periphery of the lower end of the pole is covered by the reinforcing members. The overlapping side edge portions 36 and 38 provide additional strength and moreover provide a very firm base for mounting bolts for fixing the members to the pole.

The holes 3, 5, 7 and 9 of one member are arranged to be aligned with holes of adjacent members. Some of the members have their holes at different heights so that mounting bolts will be at different heights, as described below. Alternatively, the holes 3, 5, 7 and 9 can elongate slots so that the bolts can be located at different levels.

Figure 7 shows an alternative arrangement where three members are sufficient to surround the periphery of the pole. In this arrangement the first member 2 is located as before, a second member 40 is located so that one of its edges 40 overlaps the edge 38 of the member 2 and the other of its edges 44 engages the pole. The third member 46 has its edges 48 overlapping the side edges 38 and 44 of the other two members. It will be appreciated that in modified arrangements a greater or lesser number of members

may be employed. Further, it is preferred that the entire periphery of the pole is surrounded by the members.

Once the members have been driven into the ground adjacent to the pole, they are then affixed to the pole so as to firmly hold them in engagement with the pole and thereby reinforce the pole. It would be possible to use straps 50 which extend about the members, as illustrated in Figure 10. It is preferred however to use a special form of bolting arrangement which is diagrammatically illustrated in Figure 9. In this arrangement, bolts 52 are used to securely hold the members to the pole. It is first necessary to align the holes 3, 5, 7 and 9 through the overlapped edges of the members. Bores 56 are then made through the pole so as to communicate with the holes at the opposite side of the pole. The bore 56 is most conveniently accomplished by using a bit 58 in conjunction with a guide jig 60.

The next step is to use a reamer 62 in order to ream wide end portions 66 at either side of the pole, as shown in Figure 9. Ferrules 68 are then inserted into the end portions 66 and a nut 70 on the bolt is tightened so as to tightly clamp the ferrules 68 towards one another. The ferrules are generally cup-shaped and have annular lip portions 72 which engage the members so that the clamping forces applied by the bolts 52 are transmitted to the members. This serves to strongly force the reinforcing members into the outer periphery of the pole and therefore very substantially increases the effective strength of the pole.

In practice a number of bolts with ferules would be used at spaced locations along the pole above ground level. As shown in Figure 10, four such bolts are used.

Figure 6 shows transverse lines 74 and 76 indicating the preferred positions of the axes of the bolts.

In Figure 7 the bolts would follow lines 78. In this case three upper and three lower bolts would be used. In the arrangements of Figure 7, a different form of ferrule (not shown) would be required which has its lip arranged at an oblique angle relative to its axis so that it would engage the surrounding parts of the members.

Finally, a number of straps 50 under tension may be located just above ground level, as illustrated in Figure 10, in order to provide additional clamping force between the members and the pole.

Many modifications will be apparent to those skilled in the art without departing from the spirit and scope of the invention.



## CLAIMS

1. A method of reinforcing a pole (4), the method comprising the steps of placing a first elongate reinforcing member (2) adjacent to the pole (4), said elongate member being curved in transverse cross-section so as to partly surround the periphery of the pole, driving the member downwardly so that its lower portion is embedded in the ground adjacent to the buried end of the pole, placing a second elongate member (2) adjacent to the pole, said second elongate member being curved in transverse cross-section so as to partly surround the periphery of the pole and being located so that one edge region thereof overlaps one edge region of the first member, driving the second elongate member so that its lower portion is embedded in the ground adjacent to the buried end of the pole and fixing the first and second members to the pole.

2. A method as claimed in claim 1 including the step of placing a third elongate member adjacent to the pole, said third elongate member being curved in transverse cross-section so as to partly surround the periphery of the pole and being located so that edge regions thereof overlap with edge regions of both the first and second members, driving the third elongate member into the ground so that its lower end portion is embedded in the ground adjacent to the buried end of the pole and fixing the third member to the pole.

3. A method as claimed in claim 1 wherein there are third and fourth of said members and all of said members are placed adjacent to the pole with adjacent edges regions of the members overlapping so as to

surround the periphery of the pole, driving the members into the ground adjacent to the buried end of the pole, and fixing all members to the pole.

4. A method as claimed in claims 3 or 4 wherein the members (2) are fixed to the pole by bolts which pass through the pole.

5. A method as claimed in claim 4 including the drilling holes (56) through the pole, enlarging end portions (66) of the holes,

placing ferrules (68) through openings in the members so as to extend into said enlarged end portions,

passing the bolts through the holes so that respective ends are located in ferrules on opposite sides of the pole, and

tightening nuts (70) on one of the ends of each bolt.

6. A method as claimed in claim 5 including the step of placing a member of tension straps (50) about the members so as to clamp the members to the pole.

7. A method as claimed in claim 2 or 3 including the step of providing restraining means (20) on the pole so as to hold the members against the pole whilst they are being driven downwardly.

8. Apparatus for reinforcing a pole, (4) said apparatus comprising an elongate member (2) which is curved in transverse cross-section so as to partly surround, in use, the periphery of a pole, at least one projection (6) extending laterally from the convex side of the member said projection being adapted to receive, in use, downward driving forces to drive the member into the ground, and openings (3, 5, 7, 9) in said member for receiving bolts (52) for fixing the member to the pole.

9. A pole having a reinforced buried end comprising:

a plurality of elongate members (2) each being curved in cross-section,

said members being spaced about the pole (4) with their convex sides adjacent to the pole and with their lower ends buried in the ground adjacent to the pole, and

fixing means (52, 68) for fixing the members to the pole.

10. A pole as claimed in claim 9 wherein adjacent edges of the members overlap.

11. A pole as claimed in claim 9 wherein the fixing means comprises bolts (52) which pass through openings (3, 5, 7, 9) in the members and through bores (56) through the pole (4).

12. A pole as claimed in claim 11 wherein the fixing means includes cup-shaped elements (68) each having a flange (72) projecting outwardly from its free edge, said elements being located in widened end portions (66) of said bores such that the flanges (72) bear against the convex sides of the members adjacent to said openings (3, 5, 7, 9).

13. A pole as claimed in claim 12 wherein each bolt has a head at one end and a nut (70) at the other, the heads and nuts of the bolts being located in said elements (68) at opposite sides of the pole.

14. A pole as claimed in claim 11 including tension straps (50) which extend about the members and clamp them to the pole.

1/6

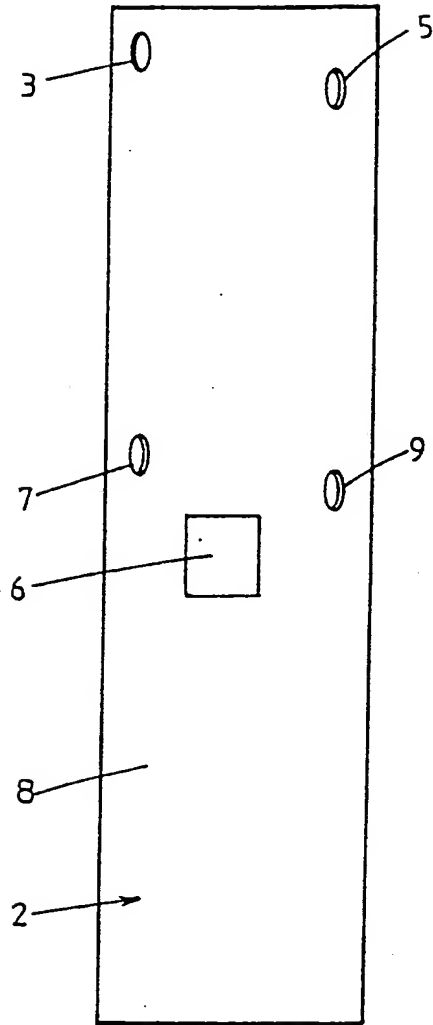


FIG 1

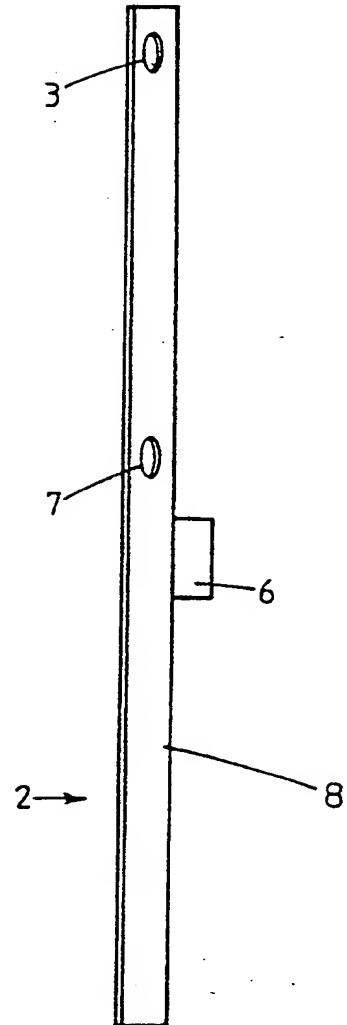


FIG 2

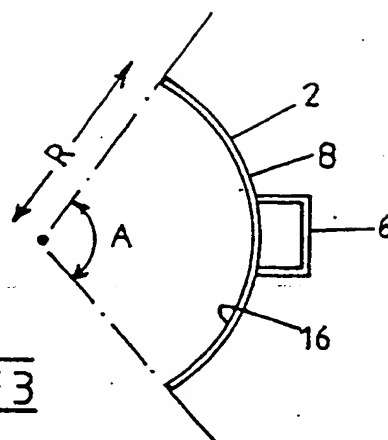


FIG 3

2/6

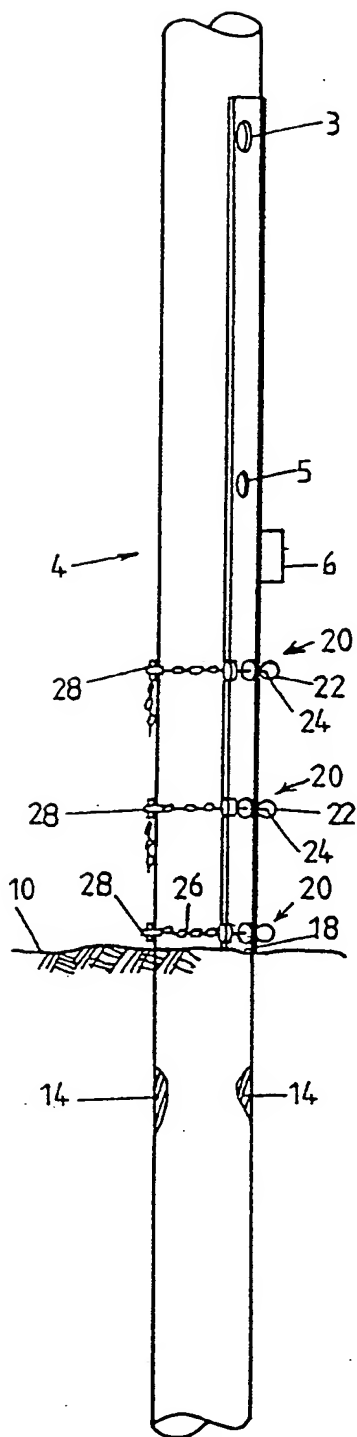


FIG 4

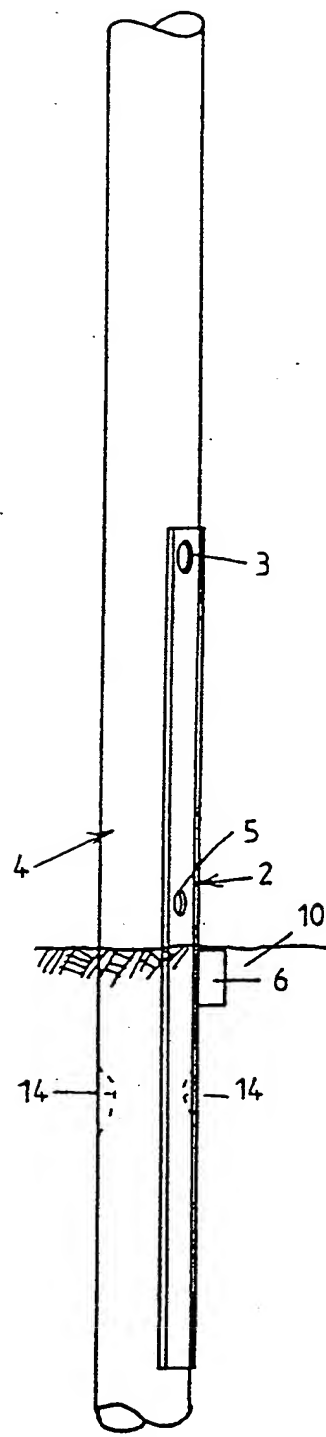
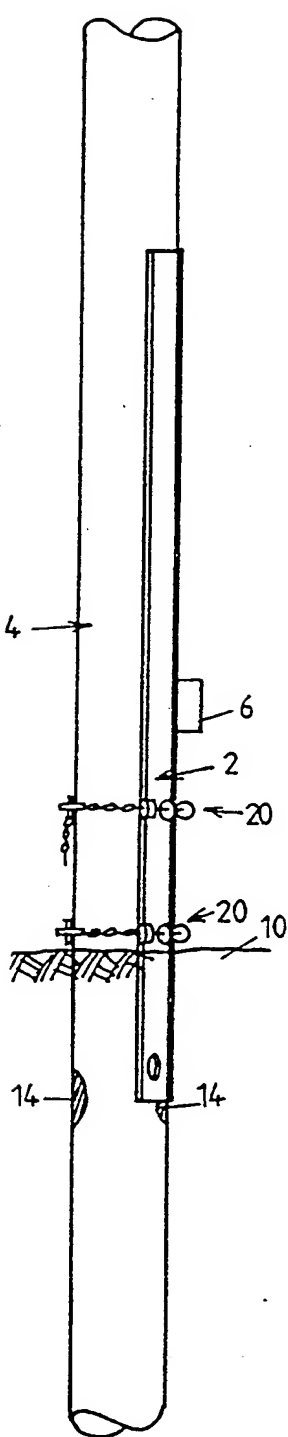
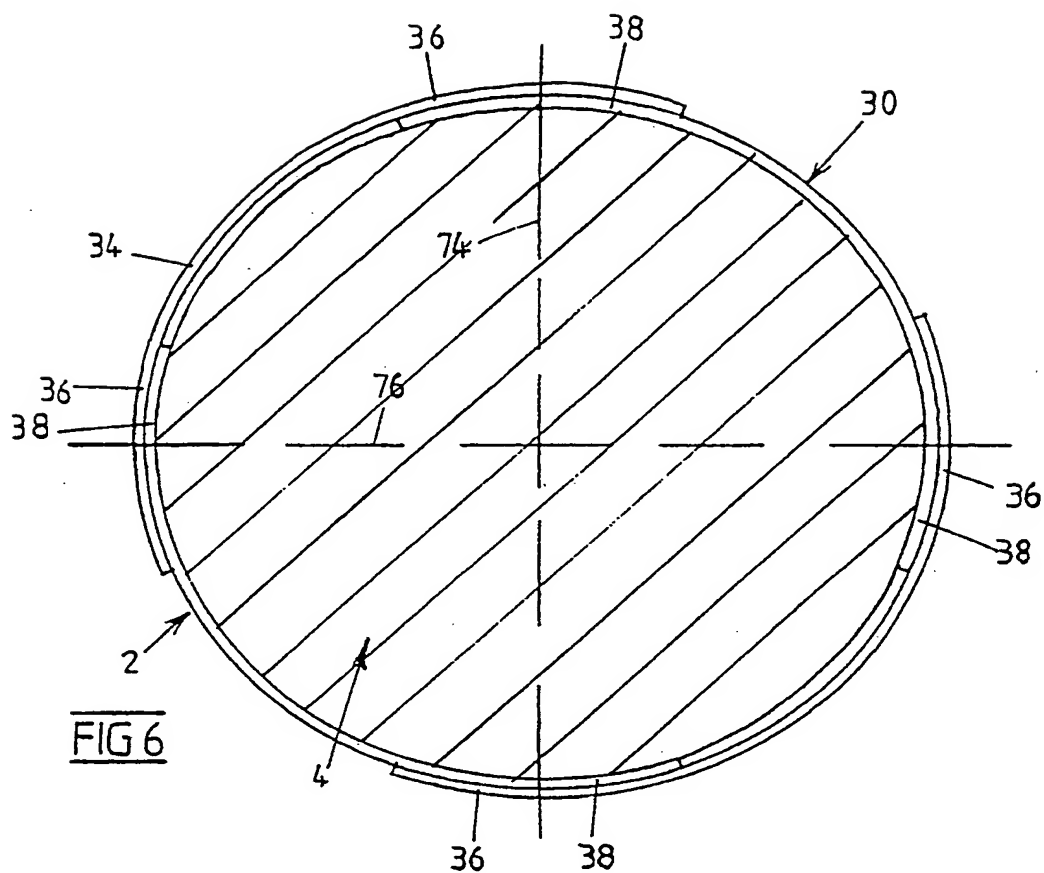


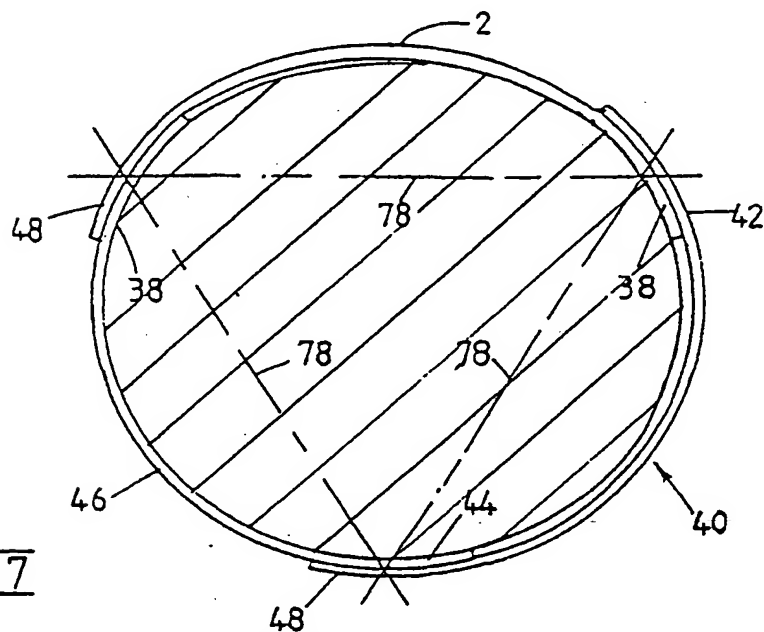
FIG 5

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3/6



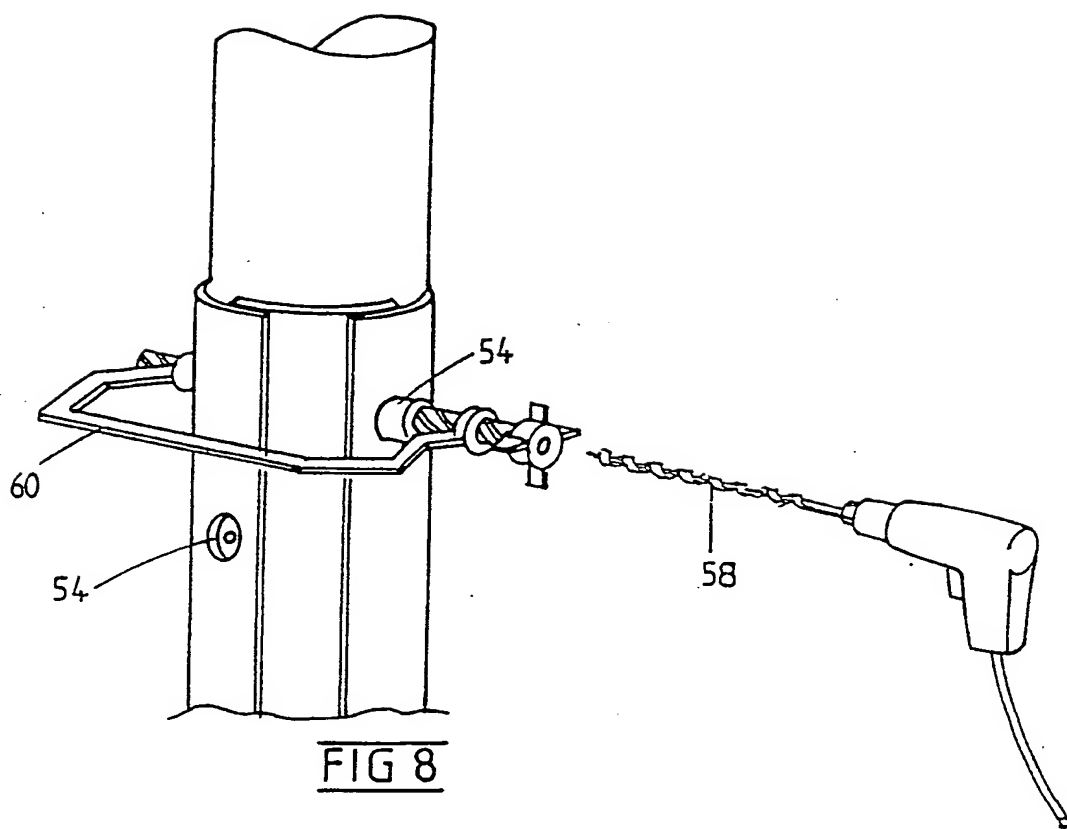
**FIG 6**



**FIG 7**

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4/6



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5/6

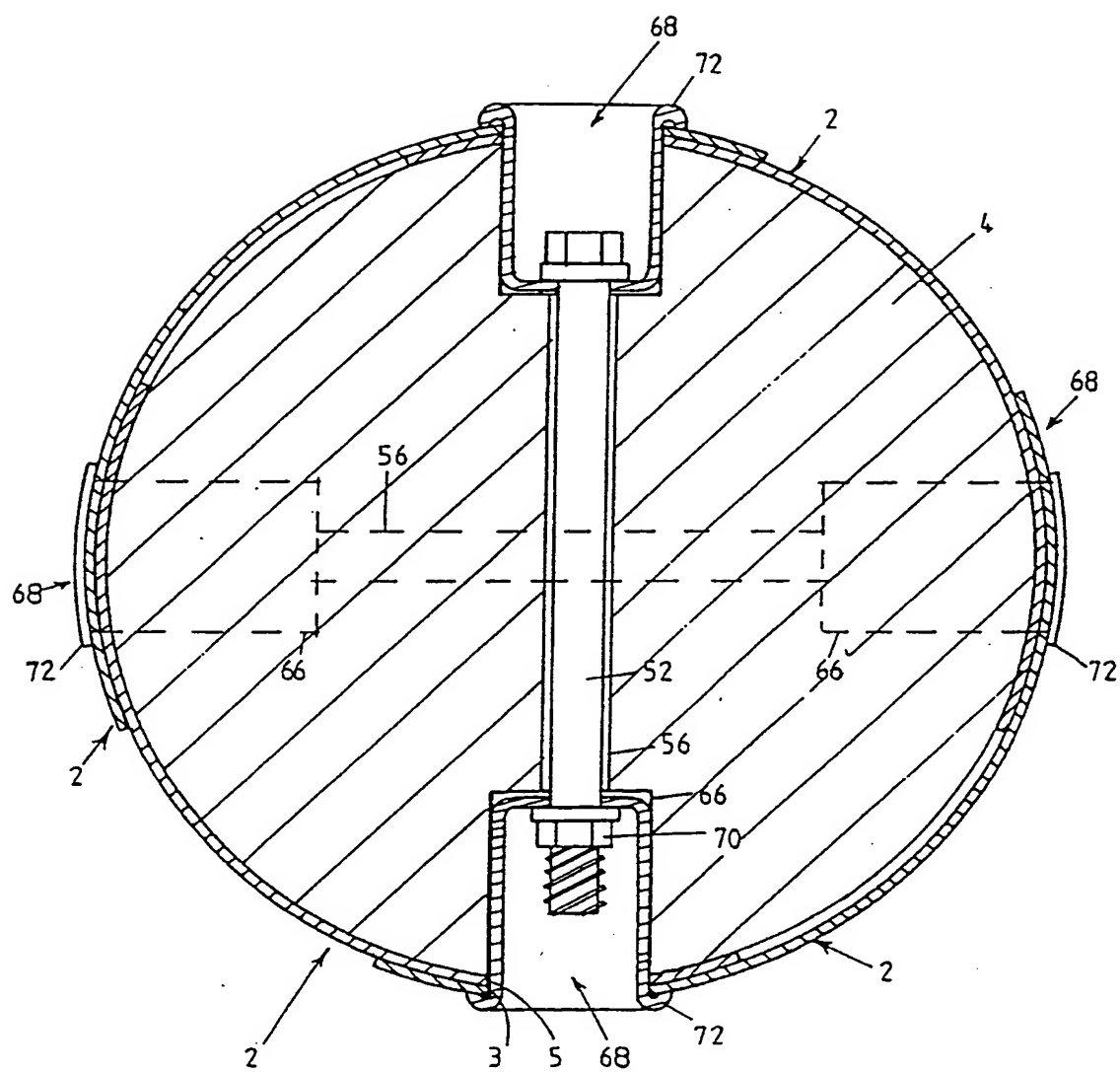


FIG 9

**SUBSTITUTE SHEET**

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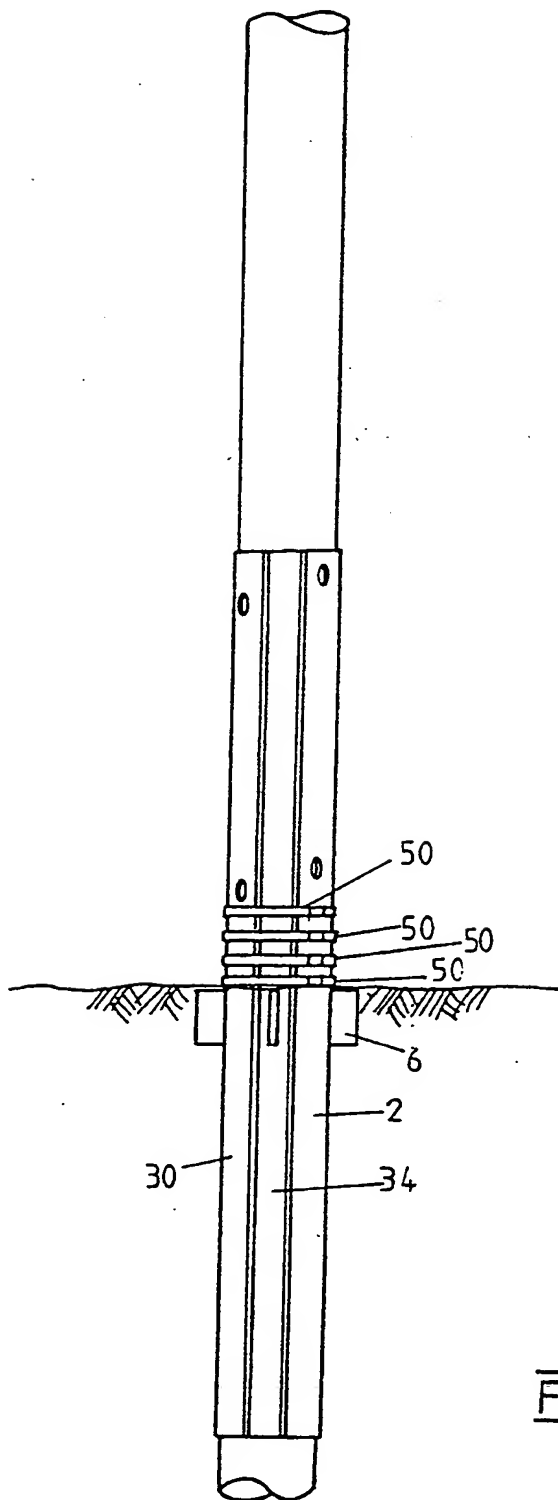


FIG 10

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# INTERNATIONAL SEARCH REPORT

International Application No. PCT/AU 87/00379

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (1) See also classification symbols 3209, indicate 311) * According to International Patent Classification (IPC) or to both National Classification and IPC <div style="text-align: center; font-size: 1.2em;">Int. Cl.<sup>4</sup>      E04H 12/20, 12/22</div>						
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; font-size: 0.8em;">Minimum Documentation Searched *</div> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%; border: none;">Classification System</td> <td style="border: none;">Classification Symbols</td> </tr> <tr> <td style="text-align: center; padding: 5px;">IPC</td> <td style="text-align: center; padding: 5px;">E04H 12/20, 12/22</td> </tr> </table>			Classification System	Classification Symbols	IPC	E04H 12/20, 12/22
Classification System	Classification Symbols					
IPC	E04H 12/20, 12/22					
<div style="text-align: center; font-size: 0.8em;">Documentation Searched other than Minimum Documentation to the extent that such documents are included in the fields searched *</div>						
<div style="text-align: center; font-size: 1.1em;">AU : IPC E04H 12/20, 12/22, E02D 5/26</div>						
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT *</b>						
Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages **	Relevant to Claim No. **				
X	GB,A, 2162561 (TARN) 5 February 1986 (05.02.86)	(9)				
X	EP,A, 109264 (CHAPMAN) 23 May 1984 (23.05.84)	(8,9)				
X	US,A, 4280567 (IJÄS) 28 July 1981 (28.07.81)	(9)				
X	US,A, 3350822 (NACHAZEL) 7 November 1967 (07.11.67)	(9)				
X	DE,A, 819575 (STARKSTROMANLAGEN A.G.) 5 November 1951 (05.11.51)	(8,9)				
X	US,A, 2265452 (RUGGIERI) 9 December 1941 (09.12.41)	(8,9)				
X	US,A, 1789393 (SPRING) 20 January 1931 (20.01.31)	(8,9)				
X	US,A, 1726371 (SPRING) 27 August 1929 (27.08.29)	(1,8,9)				
X	CH,A, 85637 (PONSOLE) 1 July 1920 (01.07.20)	(8,9)				
A	WO,A, 85/02435 (KINNAN) 6 June 1985 (06.06.85)	(1,8,9)				
A	GB,A, 2139663 (PYRAH) 14 November 1984 (14.11.84)	(1,8,9)				
<div style="font-size: 0.8em;">           * Special categories of cited documents: **            - "A" document defining the general state of the art which is not considered to be of particular relevance            - "E" earlier document but published on or after the international filing date            - "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)            - "O" document referring to an oral disclosure, use, exhibition or other means            - "P" document published prior to the international filing date but later than the priority date claimed            - "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention            - "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step            - "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art            - "A" document member of the same patent family         </div>						
<b>IV. CERTIFICATION</b>						
Date of the Actual Completion of the International Search <div style="text-align: center; font-size: 1.1em;">26 February 1988 (26.02.88)</div>		Date of Mailing of this International Search Report <div style="text-align: center; font-size: 1.1em;">(08.03.88) 8 MARCH 1988</div>				
International Searching Authority <div style="text-align: center; font-size: 1.1em;">Australian Patent Office</div>		Signature of Authorized Officer <div style="text-align: center;">               HUGH NESS         </div>				

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers ..... because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claim numbers ..... because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically
  
3. ☐ Claim numbers ..... because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☒ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This International Searching Authority found multiple inventions in this international application as follows:

Claims 1 and 8 are directed to reinforcing a pole in use by surrounding the periphery of the pole with an elongate member which has a projection by which the member is driven into the ground adjacent the pole's buried end, the member then being fixed to the pole.

Claim 9 is directed to a pole which has an elongate member attached to its lower buried end.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:
  
3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:
  
4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remarks on Protest

- ☐ The additional search fees were accompanied by applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON  
INTERNATIONAL APPLICATION NO. PCT/AU 87/00379

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report			Patent Family Members			
US	4280567	AT 4371/79 DK 2719/79 IT 1119013	BE 877299 FR 2438123 NO 792142	DE 2925955 GB 2025495 SE 7905196		
WO	8502435	AU 23467/84	EP 165235	US 4697959		
EP	109264	EP 109264	US 4516365	US 4598512		
GB	2139663	GB 2138859	GB 2169017			

END OF ANNEX